

REMARKS

Claims 1 - 26 are pending in this application. Claims 1, 8, 11, and 22 have been amended, claim 2 has been cancelled, and claims 27 and 28 have been added. Applicant reserves the right to pursue the original claims and other claims in this and in other applications.

Claims 1, 3, 4, and 7 stand rejected under 35 U.S.C. § 102(e) as being unpatentable over Itani (U.S. Patent No. 6,707,492) ("Itani"). Reconsideration is respectfully requested.

Claim 1 has been amended to incorporate the subject matter of now canceled dependant claim 2.

Claims 2, 8, 11, and 13-20 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Itani in view of Venus (U.S. Patent No. 5, 668,501) ("Venes"). Reconsideration is respectfully requested.

The claimed invention seeks to address the problem that occurs when "the unity gain frequency of its amplifier is selected to satisfy the settling time for the worst-case condition....For any gain setting lower than the maximum gain setting, the amplifier draws more power than is necessary for the required settling time." (Spec., ¶ 0004).

Claim 1 recites, *inter alia*, a method of controlling gain in a pixel array comprising "changing the gain of an amplifier in a gain stage of a sensor in response to a signal read out from a pixel array in the sensor, wherein said gain stage is in an output path to an analog to digital converter for readout; and changing the power consumption of the amplifier in the gain stage in response to changing the gain, wherein said changing the power consumption comprises changing a transconductance of at least one input transistor in the amplifier."

Itani discloses “a gain characteristic correctable dynamic range enhancement system [that] receives input signals from an imager device connected to a correlated double sampling ...circuit .”

Itani fails to disclose or suggest “changing the power consumption of the amplifier in the gain stage in response to changing the gain, wherein said changing the power consumption comprises changing a transconductance of at least one input transistor in the amplifier.” As noted in the Office Action, “Itani does not teach changing the power consumption by changing a transconductance of an input transistor in the amplifier by generating two or more bias currents having bias current values associated with the selected gain setting and applying the two or more bias currents to a plurality of parallel transistors I the amplifier to change the input transconductance...”

Venes seeks to address the problem that “[i]n mixed analogue and digital applications it is, however, desirable to be able to change the transconductance in response to a binary control signal. This usually involves using a D/A converter for converting the binary control signal into an analogue control signal. A drawback of this method is that a D/A converter is needed.” (Venes, Col. 1, 51-56).

Venes fails to disclose or suggest “changing the gain of an amplifier in a gain stage of a sensor in response to a signal read out from a pixel array in the sensor... wherein said gain stage is in an output path to an analog to digital converter for readout.” (Emphasis added) As generically noted in a previous Office Action, “Venes does not teach the gain stage being within a sensor having an active (APS) pixel array having pixels arranged in rows and columns and the signals as a pixel signal read out form the pixel using a readout circuit.”

Venus does not teach how to modify or use Itani to attain the claimed invention. Further, there is no motivation or suggestion provided in the references to combine the teachings of Venes with the teachings of Itani as these patents are directed to

solving very different problems. There is no suggestion in either on how or why their teachings could be combined.

Accordingly, the rejection of claim 1 should be respectfully withdrawn for at least the reasons noted above.

Claims 3, 4, and 7 depend from claim 1 and incorporate, directly or indirectly, the limitations thereof and are allowable for at least the reasons stated above. Accordingly, withdrawal of the rejection of claims 3, 4, and 7 is respectfully requested.

Claim 8 recites, *inter alia*, a method of controlling gain in a pixel array comprising “selecting one of a plurality of gain settings in response to a signal read out from a pixel array in a sensor; generating two or more bias currents having bias current values associated with the selected gain setting; and applying said two or more bias currents to a plurality of sets of two parallel transistors in an amplifier in a gain stage of the sensor in order to change the input transconductance of the amplifier, wherein said gain stage is in an output path to an analog to digital converter for readout.”

Neither Itani nor Venus suggest or disclose a method of controlling gain in a pixel array comprising “applying said two or more bias currents to a plurality of sets of two parallel transistors in an amplifier.” Venus does not teach how to modify or use Itani to attain the claimed invention. Therefore the rejection of claim 8 should be withdrawn.

Claim 11 recites, *inter alia*, an apparatus comprising “a gain stage for a sensor of an active pixel sensor array, wherein said gain stage is in an output path to an analog to digital converter for readout and said gain stage having a differential amplifier providing gain by adjusting an input capacitance and a feedback capacitance, said differential amplifier including a gain selector operative to select one of a plurality of gain settings in response to a signal from said pixel array, an input transistor having a variable input transconductance, and a transconductance controller operative to select an input transconductance of the input transistor in response to a selected gain setting.”

Neither Itani nor Venus suggest or disclose an apparatus comprising “a differential amplifier providing gain by adjusting an input capacitance and a feedback capacitance” Nor does Venus teach how to modify or use Itani to attain the claimed invention. Therefore the rejection of claim 11 should be withdrawn.

Claims 13-17 depend from claim 11 and are allowable for at least the reason noted above. Therefore the rejection of claims 13-17 should be withdrawn.

Claim 18 recites, *inter alia*, a sensor comprising “a pixel array comprising a plurality of pixels arranged in rows and columns; a read-out section operative to read out signals generated by pixels in the pixel array; a gain stage wherein said gain stage is in an output path to an analog to digital converter for readout and said gain stage having a differential amplifier including a gain selector operative to set the differential amplifier to one of a plurality of gain settings in response to a pixel signal read out from the pixel array, an input transistor having an input transconductance and including a first plurality of parallel transistors connected to a first bias current supply and a second plurality of parallel transistors connected to a second bias current supply, and a transconductance controller operative to change the transconductance of the input transistor to match a selected gain setting by selectively applying different bias currents to at least one of said first and second bias current supplies for different gain settings.”

Neither Itani nor Venus suggest or disclose “an input transistor having an input transconductance and including a first plurality of parallel transistors connected to a first bias current supply and a second plurality of parallel transistors connected to a second bias current supply” and “a transconductance controller operative to change the transconductance of the input transistor to match a selected gain setting by selectively applying different bias currents to at least one of said first and second bias current supplies for different gain settings.” Nor does Venus teach how to modify or use Itani to attain the claimed invention. Therefore the rejection of claim 18 should be withdrawn.

Claims 19-20 depend from claim 18 and are allowable for at least the reason noted above. Therefore the rejection of claims 19-20 should be withdrawn.

Claims 22-26 stand rejected under 35 U.S.C. § 102(b) as being unpatentable over Nakano (U.S. Patent No. 5,905,256) (“Nakano”) Reconsideration is respectfully requested.

Claim 22 recites, *inter alia*, a method of controlling gain in a pixel array comprising “changing the gain of an differential amplifier in a gain stage of a sensor in response to a signal read out from a pixel array in the sensor; and changing a gain bandwidth (GBW) of the differential amplifier in the gain state in response to changing the gain.”

Nakano discloses an imaging device utilizing a source-follower amplifier with an changeable gain bandwidth. (Nakano, Summary)

As Nakano relates to source-follower amplifiers, Nakano fails to disclose “changing the gain of an differential amplifier in a gain stage of a sensor in response to a signal read out from a pixel array in the sensor; and changing a gain bandwidth (GBW) of the differential amplifier in the gain state in response to changing the gain.” Therefore the rejection of claim 22 should be withdrawn.

Claims 23-26 depend from claim 22 and incorporate, directly or indirectly, the limitations thereof and are allowable for at least the reasons stated above. Accordingly, withdrawal of the rejection of claims 23-26 is respectfully requested.

Claim 5 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Itani. Reconsideration is respectfully requested.

Claim 5 depends from claim 1 and incorporate, directly or indirectly, the limitations thereof and is allowable for at least the reasons stated above. Therefore the rejection of claim 5 should be withdrawn.

Claims 6, 9, 10, and 12 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Itani (in view of Venus for claims 9, 10, and 12) in view of Nakano. Reconsideration is respectfully requested.

Claim 6 depends from claim 1 and incorporate, directly or indirectly, the limitations thereof and is allowable for at least the reasons stated above. Therefore the rejection of claim 6 should be withdrawn.

Claims 9 and 10 depend from claim 8 and incorporate, directly or indirectly, the limitations thereof and are allowable for at least the reasons stated above. Therefore the rejection of claims 9 and 10 should be withdrawn.

Claim 12 depends from claim 11 and incorporate, directly or indirectly, the limitations thereof and is allowable for at least the reasons stated above. Therefore the rejection of claim 12 should be withdrawn.

Claim 21 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Itani in view of Venus in view of Mathur (U.S. Pat. No. 6,661,457) (“Mathur”). Reconsideration is respectfully requested.

Mathur seeks to address the problem that in image arrays “[e]xisting read-out circuitry generates mixed color data....This requires sorting of the mixed color data stored in the memory. This increases processing requirements at the image processor which contributes to increased cost, power consumption and weight of a digital camera. Therefore, there is a need for facilitating color extraction which reduces the requirements for processing at a digital image processor.” (Mathur, Col. 2., l. 12 -27) Mathur discloses an architecture for efficient extraction of data from photo sensors. (Mathur, Col. 2., l. 29 - 31). Mathur does not teach how to modify or use Venes nor Itani to attain the claimed invention.

Further, there is no motivation or suggestion provided in the references to combine the teachings of Venes with the teachings of Itani and Mathur as these patents are directed to solving very different problems. There is no suggestion in either on how or why their teachings could be combined. Thus the rejection of claim 21 should be withdrawn

Claims 27 and 28 have been added. As these claims depend from claim 8, they are allowable for at least the reasons noted above.

In view of the above, each of the presently pending claims in this application is believed to be in immediate condition for allowance. Accordingly, the Examiner is respectfully requested to pass this application to issue.

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Respectfully submitted,

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